AD-A172 050 PULSED LASER PROCESSES ON SURFACES: FORMATION OF STRUCTURAL DEFECTS MEASU (U) NORTHWESTERN UNIV EVANSTON IL DEPT OF CHEMISTRY P C STAIR 07 FEB 86 1/1

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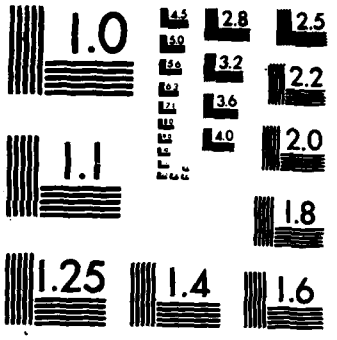

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AFOSR-TR- 86-0739

AD-A172 050

Final Report

AFOSR-84-0199

Northwestern University

Peter C. Stair

1 July 1985 - 31 December 1985

Pulsed Laser Processes on Surfaces: Formation of Structural Defects, Measurement of Surface Diffusion and Direct Detection of Reaction Intermediates

7 February 1986

University Research Instrumentation Program

Final Report for Grant No: AFOSR-84-0199

Equipment Purchased

Item	Manufacturer	Price
Innova 12-UV Argon Ion Laser	Coherent, Inc.	
EMG 101MSC Excimer Laser	Lambda-Physik	
FL 2002 Pulsed Dye Laser	Lambda-Physik	
Package Price for Above Items		$ 104,249
SLL-1050 Flashlamp Pumped Dye Laser	Candela Corporation	16,000
2 - Optical Tables and 8 Legs	Newport Corporation	9,220
1510-P1C CAMAC Crate	Kinetic Systems	1,490
3501 CAMAC Crate Controller	LeCroy Research Systems	1,095
3500-25 Intelligent CAMAC Interface	LeCroy Research Systems	4,995
TR8837F Transient Recorder	LeCroy Research Systems	2,400
CD8828B Control and Display	LeCroy Research Systems	990
2 - 3514 Spectroscopy ADC	LeCroy Research Systems	4,990
Model 310 Microcomputer	Intel Corporation	18,330
Model 12 Shielded Enclosure	Lindgren RF Enclosures	8,237
Model 1560 Oscilloscope	Dynascan Corporation	900

All of the above equipment items were either listed on the original grant or were purchased after prior written permission of the Contracting Officer.

Research Projects Making Use of the Above Equipment

"The Role of Surface Structural Defects in Surface Chemistry"

Support: AFOSR

The purpose of the research is to elucidate the influence of surface structural defects on the kinetics of aluminum surface oxidation. Two classes of surface defects are of particular interest: 1) atomic height steps and kinks that are localized at the surface and 2) mosaic boundaries and lattice strain that extend below the surface. The experimental program is organized along two parallel lines: characterization of surface defect structure by LEED and investigation of the influence this structure has on oxidation rates. The project makes use of the computer data acquisition system purchased on the instrumentation grant to perform quantitative LEED measurements in order to characterize the surface defect structure.

"The Formation and Surface Chemistry of Laser-Induced Defects"

Support: Proposal Pending at AFOSR

The purpose of the research is to develop a fundamental understanding of the formation and surface chemistry of atomic scale structural defects produced by the interaction of pulsed laser radiation with metal surfaces. The research program is divided into two parallel efforts: 1) Clarification of the mechanism of atomic scale defect formation by low to medium energy laser pulses with aluminum and aluminum-magnesium alloy single crystal surfaces, and 2) Elucidation of the mechanism and rates of individual steps in the reaction of oxygen and water with the defects formed by pulsed lasers. Pulsed lasers

purchased on the instrumentation grant will be used to produce surface defect structures. In addition surface diffusion of reactants is measured by a technique which combines pulsed laser-induced desorption to create a coverage gradient and spatially resolved photoemission yield measurements to monitor the diffusion out of the coverage gradient.

"The Nature of Catalytically Active Surfaces"

Support: NSF

The purpose of this research is to elucidate the nature of the active catalytic surface at a microscopic level and to understand why the surface is active using the traditional chemical concept of Lewis acids and bases. The experimental plan combines fabrication of well defined single crystal catalysts, extensive catalyst characterization before and after reaction by surface science techniques, evaluation of catalystic activity and selectivity under realistic conditions and in-situ monitoring of the catalyst surface by surface Raman spectroscopy. The argon ion laser purchased on the instrument grant is used as the excitation source for Raman spectroscopy measurements.

"The Mechanism of Lubricant Film Breakdown"

Support: Northwestern University Center for Engineering Tribology

The chemical reaction mechanisms of lubricant oil films on bearing surfaces are not well understood. In the present study the decomposition of lubricant oils on iron foil surfaces which serve as models for the surface of bearing materials is monitored under vacuum conditions by XPS and in-situ by surface Raman spectroscopy. The argon ion laser is used for the Raman,

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This grant was a result of the DOD-URIP Program which funded the purchase of equipment for the university to do Air Force research.

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